## - Specifications

| Item | Specification |
|---|---|
| Master cylinder<br>• Type<br>• I.D. mm (in)<br>• Piston stroke mm (in)<br>• Fluid level switch | <br>Tandem<br>22.22 mm (0.87 in)<br>45 ± 1 mm (1.77 in ± 0.87 in)<br>Provided |
| Brake booster<br>• Type<br>• Boosting ratio | <br>10.5" Single<br>10:1 |
| Front brake (Disc)<br>• Type<br>• Disc O.D<br>• Disc thickness<br>• Cylinder type<br>• Cylinder I.D. | <br>Ventilated disc<br>340 mm (13.38 in)<br>30 mm (1.18 in)<br>Double piston<br>Ø 45.99 mm (1.81 in) x 2 |
| Rear brake (Disc)<br>• Type<br>• Disc O.D<br>• Disc thickness<br>• Cylinder type<br>• Cylinder I.D | <br>Ventilated disc<br>305 mm (12.00 in)<br>11 mm (0.43 in)<br>Single piston<br>Ø 43 mm (1.69 in) [Electric type] |
| Parking brake<br>• Type<br>• Brake | <br>Electric parking brake<br>Electirc type |

## Specification (VDC)

| Part | Item | Standard value | Remark |
|---|---|---|---|
| HECU | System | 4 Channel 4 Sensor control system | Total control (ABS, TCS, EBD) |
| | Type | Motor, valve relay intergrated type | ECU, TCU and CAN |
| | Operating Voltage | 8V - 16V | |
| | Operating Temperature | -40°C - 110°C | |
| | Motor power | 195W[Nomal]] / 315W[Plus] | |
| Active Wheel speed sensor (ABS) | Supply voltage | DC 4.5 - 20V | |
| | Output current low | 5.95 - 8.05 mA | Typ .7 mA |
| | Output current high | 11.9 - 16.1 mA | Typ .14 mA |
| | Output range | 1 - 2,500 Hz | |
| | Tone wheel | Front : 52 teeth, Rear : 52 teeth | |
| | Air gap | 0.4 - 1.0 mm | |
| Steering Wheel Angle Sensor | Operating Voltage | 8V - 16V | |

| | | | |
|---|---|---|---|
| | Current Consumption | Max. 150 mA | |
| | Output measurement range | -780 to + 779.9° | |
| | Operating Angular velocity | 0 - 1016°/sec | |

## Service Standard

| Items | Standard value |
|---|---|
| Brake pedal height | 135 mm (5.31 in) |
| Brake pedal Full stroke | 176 mm (6.93 in) |
| Brake pedal free play | 1 - 2 mm (0.04 in - 0.08 in) |
| Brake pedal free play | 2 - 4 mm (0.08 in - 0.16 in) |
| Front brake disc pad thickness | 10.5 mm (0.41 in) |
| Front brake disc pad service limit | 2.0 mm (0.07 in) |
| Front brake disc thickness | 30 mm (1.18 in) |
| Front brake disc service limit | 28 mm (1.10 in) |
| Rear brake disc thickness | 11 mm (0.43 in) |
| Rear brake disc service limit | 9.0 mm (0.35 in) |
| Rear brake disc pad thickness | 10 mm (0.39 in) |
| Rear brake disc pad service limit | 2.0 mm (0.07 in) |

### - Tightening Torques

| Items | N.m | kgf.m | lb-ft |
|---|---|---|---|
| Master cylinder to brake booster | 9.8 - 15.6 | 1.0 - 1.6 | 7.2 - 11.6 |
| Brake booster mounting nuts | 16.7 - 25.5 | 1.7 - 2.6 | 12.3 - 18.8 |
| Air bleeding screw | 6.9 - 12.7 | 0.7 - 1.3 | 5.1 - 9.4 |
| Brake tube flare nut, brake hose | 13.7 - 16.7 | 1.4 - 1.7 | 10.1 - 12.3 |
| Front caliper guide rod bolts | 37.3 - 41.2 | 3.8 - 4.2 | 27.5 - 30.4 |
| Rear caliper guide rod bolts | 37.3 - 41.2 | 3.8 - 4.2 | 27.5 - 30.4 |
| Front caliper assembly mounting bolt | 98.1 - 117.7 | 10.0 - 12.0 | 72.3 - 86.8 |
| Rear caliper assembly mounting bolt | 98.1 - 117.7 | 10.0 - 12.0 | 72.3 - 86.8 |
| Brake hose to caliper | 24.5 - 29.4 | 2.5 - 3.0 | 18.1 - 21.7 |
| Brake pedal member bracket bolt | 16.7 - 25.5 | 1.7 - 2.6 | 12.3 - 18.8 |
| Wheel speed sensor mounting bolt | 6.9 - 10.8 | 0.7 - 1.1 | 5.1 - 8.0 |
| HECU bracket mounting nut | 16.7 - 25.5 | 1.7 - 2.6 | 12.3 - 18.8 |

## Lubricants

| Items | Recommended | Quantity |
|---|---|---|
| Brake fluid | DOT 3 or DOT 4 | As required |
| Brake pedal bushing and bolt | Chassis grease | As required |
| Parking brake shoe and backing plate contacting surface | Heat resistance grease | As required |



### - Special Service Tools

| | | |
|---|---|---|

| Tool (Number and Name) | Illustration | Use |
| --- | --- | --- |
| 09581-11000<br>Piston expander | Click to see large image... | Spreading the front disc brake piston. |
| 09964-C1100<br>SCC Setting Reflector | Click to see large image... | Used for front radar unit setting |
| 0K964-J5100<br>Calibration Reflector | Click to see large image... | Used for front radar unit setting |
| 09964-C1200<br>SCC Setting Beam | | Used for front radar unit setting.<br>Used for front view camera unit setting. |

| | | |
|---|---|---|
| | Click to see large image... | |
| 09964-C1300<br>SCC Setting Tripod | Click to see large image... | Used for front radar unit setting |
| 09527-AL500<br>Sensor cap installer | Click to see large image... | Used for installing wheel speed sensor cap<br>(Use with 09231-H1100) |



## - Troubleshooting

**Problem Symptoms Table**

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the like cause of the problem. Check each part in order.

If necessary, replace these parts.

| Symptom | Suspect Area | Reference |
|---|---|---|
| | | |

| | | |
|---|---|---|
| Lower pedal or spongy pedal | 1. Brake system (Fluid leaks) | repair |
| | 2. Brake system (Air in) | air·bleed |
| | 3. Piston seals (Worn or damaged) | replace |
| | 4. Rear brake shoe clearance (Out of adjustment) | adjust |
| | 5. Master cylinder (Inoperative) | replace |
| Brake drag | 1. Brake pedal free play (Minimum) | adjust |
| | 2. Parking brake lever travel (Out of adjustment) | adjust |
| | 3. Parking brake wire (Sticking) | repair |
| | 4. Rear brake shoe clearance (Out of adjustment) | adjust |
| | 5. Pad or lining (Cracked or distorted) | replace |
| | 6. Piston (Stuck) | replace |
| | 7. Piston (Frozen) | replace |
| | 8. Anchor or shoe (Inoperative) | replace |
| | 9. Booster system (Vacuum leaks) | repair |
| | 10. Master cylinder (Inoperative) | replace |
| Brake pull | 1. Piston (Sticking) | replace |
| | 2. Pad or lining (Oily) | replace |
| | 3. Piston (Frozen) | replace |
| | 4. Disc (Scored) | replace |
| | 5. Pad or lining (Cracked or distorted) | replace |
| Hard pedal but brake inefficient | 1. Brake system (Fluid leaks) | repair |
| | 2. Brake system (Air in) | air·bleed |
| | 3. Pad or lining (Worn) | replace |
| | 4. Pad or lining (Cracked or distorted) | replace |
| | 5. Rear brake shoe clearance (Out of adjustment) | adjust |
| | 6. Pad or lining (Oily) | adjust |
| | 7. Pad or lining (Glazed) | replace |
| | 8. Disc (Scored) | replace |
| | 9. Booster system (Vacuum leaks) | repair |
| Noise from brake | 1. Pad or lining (Cracked or distorted) | replace |
| | 2. Installation bolt (Loosen) | adjust |
| | 3. Disc (Scored) | replace |
| | 4. Sliding pin (Worn) | replace |
| | 5. Pad or lining (Dirty) | clean |
| | 6. Pad or lining (Glazed) | replace |
| | 7. Anchor or shoe (Faulty) | replace |
| | 8. Brake pad shim (Damage) | replace |
| | 9. Shoe hold-down spring (Damage) | replace |
| Brake fades (When fast driving) | 1. Pad or lining (Worm) | replace |
| | 2. Master cylinder (Inoperative) | replace |
| Brake vibration, pulsation | 1. Brake booster (Vacuum leaks) | replace |
| | 2. Pedal free play | adjust |
| | 3. Master cylinder (Inoperative) | replace |
| | 4. Caliper (Damage) | replace |
| | 5. Master cylinder cap seal | replace |
| | 6. Damaged brake lines | replace |

## - Brake System Bleeding

### Nomal Brake System

**NOTICE**

- Do not reuse the drained fluid.
- Always use genuine DOT3/DOT4 brake Fluid.
  Using a non-genuine DOT3/DOT4 brake fluid can cause corrosion and decrease the life of the system.
- Make sure no dirt or other foreign matter is allowed to contaminate the brake fluid.
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
- The reservoir on the master cylinder must be at the MAX (upper) level mark at the start of bleeding procedure and checked after bleeding each brake caliper. Add fluid as required.

1. Make sure the brake fluid in the reservoir is at the MAX (upper) level line.
2. Have someone slowly pump the brake pedal several times, and then apply pressure.
3. Loosen the right-rear brake bleed screw (A) to allow air to escape from the system. Then tighten the bleed screw securely.

#### [Front]

Click to see large image...

**[Rear]**

Click to see large image...

4. Repeat the procedure for wheel in the sequence shown below until air bubbles no longer appear in the fluid.
5. Follow the sequence as shown below.

Click to see large image...

6. Refill the master cylinder reservoir to MAX (upper) level line.

## ESC Bleeding of Brake System

**⚠ CAUTION**

- Be careful not to damage the parts located under the vehicle (floor under cover, fuel filter, fuel tank and canister) when raising the vehicle using the lift.
  (Refer to General Information - "Lift and Support Points")

This procedure should be followed to ensure adequate bleeding of air and filling of the ESC unit, brake lines and master cylinder with brake fluid.

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

> **NOTICE**
>
> - When pressure bleeding, do not depress the brake pedal.
> - Recommended fluid..... DOT3 or DOT4

2. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
3. Connect the GDS to the data link connector located underneath the dash panel.
4. Select and operate according to the instructions on the GDS screen.

Click to see large image...

Click to see large image...

5. Have someone slowly pump the brake pedal several times, and then apply pressure.
6. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw (A).

**Tightening torque :**
6.8 - 12.7 N.m (0.7 - 1.3 kgf.m, 5.0 - 9.4 lb-ft)

## [Front]

Click to see large image...

**[Rear]**

Click to see large image...

7. Repeat the procedure for wheel in the sequence shown below until air bubbles no longer appear in the fluid.
8. Refill the master cylinder reservoir to MAX (upper) level line.

Click to see large image...

## - Operation and Leakage Check

**⚠ CAUTION**

- Be careful not to damage the parts located under the vehicle (floor under cover, fuel filter, fuel tank and canister) when raising the vehicle using the lift.
  (Refer to General Information - "Lift and Support Points")

## Check all of the following items :

| Component | Procedure |
|---|---|
| Brake Booster (A) | Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster. Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage. |
| Piston cup and pressure cup inspection (B) | • Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. Replace the master cylinder as an assembly if the pedal does not work properly or if there is damage or signs of fluid leakage.<br>• Check for a difference in brake pedal stroke between quick and slow brake applications. Replace the master cylinder if there is a difference in pedal stroke. |
| Brake hoses (C) | Look for damage or signs of fluid leakage. Replace the brake hose with a new one if it is damaged or leaking. |
| Caliper piston seal and piston boots | Check brake operation by applying the brakes.<br>Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, disassemble and inspect the brake caliper. Replace the boots and seals with new ones whenever the brake caliper is disassembled. |

Click to see large image...

## Brake System (Judder Inspection)

Click to see large image...

## - Components

Click to see large image...

1. Reservoir cap
2. Reservoir
3. Brake booster
4. Master cylinder
5. Push rod
6. Brake booster vacuum pressure snesor (BBVPS)



## - Brake Booster Operating Test

1.

Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is inoperative.

Click to see large image...

2. With the engine stopped, step on the brake pedal several times.
   Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is inoperative.
3. With the engine running, step on the brake pedal and then stop the engine.Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is inoperative.

Click to see large image...

If the above three tests are okay, the booster performance can be determined as good.
Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for malfunction.

### - Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the air cleaner assembly.
   (Refer to Engine Mechanical System - "Air Cleaner")
3. Remove the master cylinder.
   (Refer to Brake System - "Brake Master Cylinder")

4. Remove the fixing clip and the vacuum hose (A) from the brake booster.

Click to see large image...

5. Disconnect the brake booster vacuum pressure sensor connector (A).

Click to see large image...

6. Remove the snap pin (A) and the clevis pin (B).

Click to see large image...

7. Loosen the fixed nut (A) and then removing the brake booster (B).

**Tightening torque :**
16.7 - 25.5 N.m (1.7 - 2.6 kgf.m, 12.3 - 18.8 lb-ft)

Click to see large image...

Click to see large image...

### - Inspection

1. Inspect the vacuum hose.
2. Check the boot for damage.

### - Installation

1. To install, reverse the removal procedure.

**NOTICE**

- Before installing the pin, apply the grease to the joint pin.
- Use a new snap pin whenever installing.

2. After installation, bleed the brake system.
   (Refer to Brake System - "Brake System Bleeding")
   (Refer to Brake System - "ESP System Bleeding")
3. Check the brake oil leakage and pedal operating condition.



## - Components

Click to see large image...

1. Reservoir cap
2. Reservoir
3. Reservoir pin
4. Grommet
5. Master cylinder



## - Removal

1. Turm ignition switch OFF and disconnect the negative (-) battery cable.

2. Remove the air cleaner assembly.
   (Refer to Engine Mechanical System - "Air Cleaner")
3. Disconnect the brake fluid level sensor connector (A).

Click to see large image...

4. Remove the brake fluid from the master cylinder reservoir with a syringe.

**NOTICE**

- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
- Make sure no dirt or other foreign matter is allowed to contaminate the brake fluid.

5. Separate the brake tube (A) from the master cylinder by loosening the tube flare nut.

**Tightening torque :**

18.6 - 22.6 N.m (1.9 - 2.3 kgf.m, 13.7 - 16.6 lb-ft)

Click to see large image...

6. Remove the master cylinder (A) after loosening the master cylinder nuts.

**Tightening torque :**

12.7 - 15.7 N.m (1.3 - 1.6 kgf.m, 9.4 - 11.6 lb-ft)

Click to see large image...

7. Separate the reservoir from the master cylinder after remove the screw (A).

Click to see large image...

## - Installation

1. To install, reverse the removal procedures.

**NOTICE**

- Before installing the pin, apply the grease to the joint pin.
- Use a new snap pin whenever installing.

2. After installation, bleed the brake system.

(Refer to Brake System - "Brake System Bleeding")
(Refer to Brake System - "ESP System Bleeding")

3. Check the brake oil leakage and pedal operating condition.



## - Components

Click to see large image...

### - Removal

**⚠ CAUTION**

- Be careful not to damage the parts located under the vehicle (floor under cover, fuel filter, fuel tank and canister) when raising the vehicle using the lift.
  (Refer to General Information - "Lift and Support Points")

## Brake Tube [Engine Room]

1. Disconnect the brake fiuid level switch connector, and remove the reservoir cap.
2. Remove the brake fluid from the master cylinder reservior with a syringe.

**⚠ CAUTION**

- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
- Make sure no dirt or other foreign matter is allowed to contaminate the brake fluid.

3. Remove the brake tube after loosening the flare nuts from the ESP, master cylinder and brake tube connector.

**Tightenning torque**

ESP : 18.6 - 22.6 N.m (1.9 - 2.3 kgf.m, 13.7 - 16.6 lb-ft)

Master cylinder :

18.6 - 22.6 N.m (1.9 - 2.3 kgf.m, 13.7 - 16.6 lb-ft)

Brake tube connector :

13.7 - 16.7 N.m (1.4 - 1.7 kgf.m, 10.1 - 12.3 lb-ft)

## Brake Hose

1. Disconnect the brake fluid level sensor connector (A).

Click to see large image...

2. Remove the brake fluid from the master cylinder reservoir with a syringe.

**NOTICE**

- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

3. Remove the wheel & tire.
4. Remove the tube flare nut (A).
5. Loosen the brake hose bracket bolt (B).

**Tightenning torque**

(A) : 13.7 - 16.7 N.m (1.4 - 1.7 kgf.m, 10.1 - 12.3 lb-ft)

(B) : 19.6 - 29.4 N.m (2.0 - 3.0 kgf.m, 14.5 - 21.7 lb-ft)

## [Front]

Click to see large image...

## [Rear]

Click to see large image...

6. Remove the hose after loosening the brake hose bolt (A) from the caliper.

**Brake hose to caliper**

**Tightening torque :**

24.5 - 29.4 N.m (2.5 - 3.0 kgf.m, 18.1 - 21.7)

## [Front]

Click to see large image...

**[Rear]**

Click to see large image...

### - Inspection

1. Check the brake tubes for cracks, crimps and corrosion.
2. Check the brake tube flare nuts for damage and fluid leakage.

### - Installation

1. To install, reverse the removal procedures.

**NOTICE**

- Use a new washer (A) whenever installing.

## [Front]

Click to see large image...

## [Rear]

Click to see large image...

2. After installation, bleed the brake system.
   (Refer to Brake System - "Brake System Bleeding")
   (Refer to Brake System - "ESP System Bleeding")



## - Specification

Click to see large image...

| Fluid Type |
| --- |
| DOT 3 or DOT 4 |

| Reservoir Quantity (cc) | | |
| --- | --- | --- |
| Total | A + B + C + D + E + F | 460 ± 20 |
| MAX LEVEL | A + B + C + D + E | 440 ± 20 |
| MIN LEVEL | B + C + D + E | 165 ± 20 |
| ON LEVEL | C + D + E | 135 ± 10 |
| | | |

| | | |
|---|---|---|
| PARTIAL LEVEL | D | Pri : 60 ± 5 |
| | D | Sec : 50 ± 5 |
| CLUTCH LEVEL | F | 15 ± 5 |



## - Replacement

**⚠ CAUTION**

- Be careful not to damage the parts located under the vehicle (floor under cover, fuel filter, fuel tank and canister) when raising the vehicle using the lift.
  (Refer to General Information - "Lift and Support Points")

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the brake fluid level sensor connector (A).

Click to see large image...

3. Remove the brake fluid from the master cylinder reservoir with a syringe.

**NOTICE**

- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
- Make sure no dirt or other foreign matter is allowed to contaminate the brake fluid.

4. Loosen the bleed screw (A) and depress the brake pedal repeatedly several times until the brake fluid reaches the caliper cylinder.

## [Front]

Click to see large image...

**[Rear]**

Click to see large image...

**NOTICE**

- Work from rear right, front left, rear left to front right.
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

5. Retighten the bleed screw and then make sure the brake fluid in the reservoir is at the MAX (upper) level line.
6. Loosen the right-rear brake bleed screw (A) to allow air to escape from the system. Then tighten the bleed screw securely.

## [Front]

Click to see large image...

**[Rear]**

Click to see large image...

**NOTICE**

- Work from rear right, front left, rear left to front right.
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
- Make sure the brake fluid in the reservoir is at the MAX (upper) level line.

7. Re-tighten the bleed screw.
8. Have an assistant press the brake pedal several times to pressurize it and keep it pressed.

9. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw.

## [Front]

Click to see large image...

## [Rear]

Click to see large image...

**NOTICE**

- Work from rear right, front left, rear left to front right.
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
- Make sure the brake fluid in the reservoir is at the MAX (upper) level line.

10. Repeat the procedure for wheel in the sequence until air bubbles no longer appear in the fluid.
11. Connect the negative (-) cable.

12. Connect the brake fluid level sensor.



## - Components

Click to see large image...

1. Brake member assembly
2. Stop lamp switch
3. Brake pedal arm assembly
4. Brake pedal pad

## - Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the crash pad lower panel.
   (Refer to Body - "Crash Pad Lower Panel")
3. Disconnect the stop lamp switch connector (A).

Click to see large image...

4. Separate the snap pin (A) and clevis pin (B).

Click to see large image...

5. Remove the brake pedal assembly after loosening the mounting nuts (A).

**Tightening torque :**
16.7 - 25.5 N.m (1.7 - 2.6 kgf.m, 12.3 - 18.8 lb-ft)

Click to see large image...

Click to see large image...

### - Inspection

1. Check the brake pedal for bending or twisting.
2. Check the brake pedal return spring for damage.
3. Check the stop lamp switch.
   (Refer to Brake System - "Stop Lamp Switch")

### - Installation

1. To install, reverse the removal procedures.

**NOTICE**

- When installing the clevis pin, apply the grease.
- Use a new snap pin whenever installing.



## - Components

Click to see large image...

1. Caliper body
2. Pad inner shim
3. Brake pad
4. Pad retainer
5. Caliper carrier



## - Removal

**⚠ CAUTION**

- Be careful not to damage the parts located under the vehicle (floor under cover, fuel filter, fuel tank and canister) when raising the vehicle using the lift.
  (Refer to General Information - "Lift and Support Points")

1. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire (A) from front hub.

**Tightening torque :**
107.9 - 127.5 N.m (11.0 - 13.0 kgf.m, 79.6 - 94.0 lb-ft)

**NOTICE**

- Be careful not to damage the hub bolts when removing the front wheel and tire (A).

Click to see large image...

3. Remove the hose after loosening the brake hose bolt (A) from the caliper.

**Tightening torque :**

24.5 - 29.4 N.m (2.5 - 3.0 kgf.m, 18.1 - 21.7 lb-ft)

Click to see large image...

4. Remove the caliper body (A) by loosening the guided rod bolt.

**Tightening torque :**

37.3 - 41.2 N.m (3.8 - 4.2 kgf.m, 27.5 - 30.4 lb-ft)

Click to see large image...

5. Remove the brake pad (A).

Click to see large image...

6. Remove the pad retainer (A).

Click to see large image...

7. Remove the caliper carrier (A) by loosening the caliper mouniting bolts.

**Tightening torque :**
98.1 - 117.7 N.m (10.0 - 12.0 kgf.m, 72.3 - 86.8 lb-ft)

Click to see large image...

8. Remove the front brake disc (A) by loosening the screws.

**Tightening torque :**
4.9 - 5.8 N.m (0.5 - 0.6 kgf.m, 3.6 - 4.3 lb-ft)

Click to see large image...

## - Inspection

### Front Brake Disc Thickness Check

1. Check the brake disc for damage and cracks.
2. Remove all rust and contamination from the surface, and measure the disc thickness at 24 points, at least, of same distance (5mm) from the brake disc outer circle.

**Front brake disc thickness**

- Standard : 30 mm (1.18 in)

- Service limit : 28 mm (1.10 in)
- Deviation : Less than 0.015 mm (0.0002 in.)

Click to see large image...

3. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.

## Front Brake Disc Runout Check

1. Place a dial gauge about 10mm (0.20 in) from the outer circumference of the brake disc, and measure the runout of the disc.

**Brake disc runout**

Limit : 0.050 mm (0.0016 in.) or less (new one)

Click to see large image...

2. If the runout of the brake disc exceeds the limit specification, replace the disc, and then measure the runout again.
3. If the runout does not exceed the limit specification, install the brake disc after turning it 180° and then check the runout of the brake disc again.

## - Installation

1. To install, reverse the removal procedures.
2. Use a SST (09581-11000) when installing the brake caliper assembly.

Click to see large image...

3. After installation, bleed the brake system.
   (Refer to Brake System - "Brake System Bleeding")
   (Refer to Brake System - "ESP System Bleeding")



## - Components

Click to see large image...

1. EPB actuator
2. Caliper body
3. Guide rod pin
4. Guide rod boot
5. Caliper carrier
6. Pad inner shim
7. Brake pad
8. Pad retainer
9. Pad return spring



## - Removal

**⚠ CAUTION**

- Be careful not to damage the parts located under the vehicle (floor under cover, fuel filter, fuel tank and canister) when raising the vehicle using the lift.
  (Refer to General Information - "Lift and Support Points")

1. Before removing the rear caliper, perform "Brake Pad Replacement Mode" using the GDS.

Click to see large image...

2. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.
3. Remove the rear wheel and tire (A) from the rear hub.

**Tightening torque :**
107.9 - 127.5 N.m (11.0 - 13.0 kgf.m, 79.6 - 94.0 lb-ft)

**NOTICE**

- Be careful not to damage the hub bolts when removing the rear wheel and tire (A).

Click to see large image...

4. Disconnect the EPB actuator connector (A).

Click to see large image...

5. Remove the hose after loosening the brake hose bolt (A) from the caliper.

**Tightening torque :**

24.5 - 29.4 N.m (2.5 - 3.0 kgf.m, 18.1 - 21.7 lb-ft)

Click to see large image...

6. Remove the caliper body (A) after loosening the guide rod bolt.

**Tightening torque :**

37.3 - 41.2 N.m (3.8 - 4.2 kgf.m, 27.5 - 30.4 lb-ft)

Click to see large image...

7. Remove the return spring (A).

Click to see large image...

8. Remove the brake pad (A).

Click to see large image...

9. Remove the pad retainer (A).

Click to see large image...

10. Remove the caliper carrier (A) after loosening the caliper mounting bolt.

**Tightening torque :**

98.1 - 117.7 N.m (10.0 - 12.0 kgf.m, 72.3 - 86.8 lb-ft)

Click to see large image...

11. Remove the rear brake disc (A) after loosening the screw.

**Tightening torque :**
4.9 - 5.9 N.m (0.5 - 0.6 kgf.m, 3.6 - 4.3 lb-ft)

Click to see large image...

### - Inspection

## Rear Brake Disc Thickness Check

1. Check the brake disc for damage and cracks.
2. Remove all rust and contamination from the surface, and measure the disc thickness at 24 points, at least, of same distance (5mm) from the brake disc outer circle.

**Rear Brake disc thickness**

Standard : 11 mm (0.43 in)

Service limit : 9.0 mm (0.35 in)

Deviation : less than 0.015 mm (0.0004 in)

Click to see large image...

3. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.

## Rear Brake Disc Runout Check

1. Place a dial gauge about 10mm (0.20 in.) from the outer circumference of the brake disc, and measure the runout of the disc.

**Brake disc runout**

Limit : 0.055 mm (0.0020 in.) or less (new one)

Click to see large image...

2. If the runout of the brake disc exceeds the limit specification, replace the disc, and then measure the runout again.
3. If the runout cannot be corrected by changing the position of the brake disc, replace the brake disc.

## - Installation

1. To install, reverse the removal procedures.
2. When istalling, press and rotate the piston into the caliper body until it is fully retracted.

Click to see large image...

**NOTICE**

- For the brake pad to locate on the normal operation position, depress the brake pedal halfway several times until the brake pedal gains resistance.
- After disassembling/assembling the caliper body or replacing the brake caliper, parking brake cable or brake disc, re-adjust the parking brake.

3. After installation, bleed the brake system.
   (Refer to Brake System - "Brake System Bleeding")
   (Refer to Brake System - "ESP System Bleeding")

4. After installing the rear caliper (EPB applied), perform “Brake Pad Replacement Mode” using the GDS.

Click to see large image...

5. After replacing the rear caliper, make sure that the caliper is installed correctly by performing “Check assembling (ECU replaced)” from the option.

Click to see large image...

## - Replacement

**⚠ CAUTION**

- Be careful not to damage the parts located under the vehicle (floor under cover, fuel filter, fuel tank and canister) when raising the vehicle using the lift.
  (Refer to General Information - "Lift and Support Points")

## Front Brake Pad

1. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire (A) from front hub.

**NOTICE**

- Be careful not to damage the hub bolts when removing the front wheel and tire (A).

Click to see large image...

3. Up the brake caliper body (A) by loosening the guided rod bolt.

Click to see large image...

4. Remove the brake pad (A).

Click to see large image...

5. Replace the pad retainer (A) with a new one.

Click to see large image...

6. Replace the brake pad (A) with a new one.

Click to see large image...

**NOTICE**

- When installing, use a new one return spring (A), pad retainer (B), inner shim (C).

Click to see large image...

7. Use a SST (09581-11000) when installing the brake caliper assembly.

Click to see large image...

8. Install the caliper body (A) then tighten the guide rod bolt.

**Tightening torque :**

37.3 - 41.2 N.m (3.8 - 4.2 kgf.m, 27.5 - 30.4 lb-ft)

Click to see large image...

9. Install the front wheel and tire (A).

**Tightening torque :**
107.8 - 127.4 N.m (11.0 - 13.0 kgf.m, 79.5 - 94.0 lb-ft)

Click to see large image...

## Rear Brake Pad

1. Before removing the rear caliper, perform "Brake Pad Replacement Mode" using the GDS.

Click to see large image...

2. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.
3. Remove the rear wheel and tire (A) from the rear hub.

**NOTICE**

- Be careful not to damage the hub bolts when removing the rear wheel and tire (A).

Click to see large image...

4. Disconnect the EPB actuator connector (A).

Click to see large image...

5. Remove the caliper body (A) after loosening the guide rod bolt.

Click to see large image...

6. Remove the pad return spring (A).

Click to see large image...

7. Remove the brake pad (A).

Click to see large image...

8. Replace the pad retainer (A) with a new one.

Click to see large image...

9. Replace the brake pad (A) with a new one.

Click to see large image...

**NOTICE**

- When installing, use a new one return spring (A), pad retainer (B), inner shim (C). brake pad (D).

Click to see large image...

10. Install the pad return spring (A).

Click to see large image...

**NOTICE**

- Pad return springs must be replaced with new ones whenever pads are replaced.
- Technicians should be careful not to deform pad return springs.
- When pad return springs are deformed, it may cause improper braking, more fuel consumption.

11. Rotate the caliper piston and push the direction of the arrow.

Click to see large image...

12. Install the caliper body (A) then tighten the guide rod bolt.

**Tightening torque :**

37.3 - 41.2 N.m (3.8 - 4.2 kgf.m, 27.5 - 30.4 lb-ft)

Click to see large image...

13. Install the rear wheel and tire (A).

**Tightening torque :**
107.9 - 127.5 N.m (11.0 - 13.0 kgf.m 79.6 - 94.0 lb-ft)

**NOTICE**

- Be careful not to damage the hub bolts when removing the rear wheel and tire (A).

Click to see large image...

14. After replacing the brake pad (EPB applied), perform "Brake Pad Replacement Mode" using the GDS.

Click to see large image...

**NOTICE**

- After replacing the brake pad is complete, make sure to repeat engagement/disengagement 3 times at "Brake Pad Replacement Mode".

15. After replacing the brake pad, make sure that the caliper is installed correctly by performing "Check assembling (ECU replaced)" from the optional function.

Click to see large image...

## - Inspection

### Front Brake Pad Check

1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

**Front brake disc Pad thickness**

- Standard : 10.5 mm (0.41 in)
- Service Limit : 2.0 mm (0.07 in)

Click to see large image...

2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

## Rear Brake Pad Check

1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

**Rear brake disc pad thickness**

- Standard : 10 mm (0.39 in)
- Service Limit : 2.0 mm (0.07 in)

2. Check the damage of pad, backing metal and contamination with grease.

## - Components

Click to see large image...

1. Brake member assembly
2. Stop lamp switch
3. Brake pedal arm assembly
4. Brake pedal pad



## - Schematic Diagram

Click to see large image...

- System circuit diagram

Click to see large image...

- Terminal function

Click to see large image...

| Teminal | Description |
|---|---|
| 1 | IGN1 |
| 2 | Engine Control Module (ECM) |
| 3 | - |
| 4 | B+ |
| 5 | Stop Lmap |
| 6 | Gruound |

## - Adjustment

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the lower crash pad.
   (Refer to Body - "Crash Pad")
3. Confirm the gap between stop lamp switch and bracket.

   **Stop lamp clearance (A) :**1.0 - 2.0 mm (0.04 - 0.08 in.)

   Click to see large image...

4.

If the gap between stop lamp switch and bracket is not 1.0-2.0mm (0.04-0.08in), check the mounting clip and other part of around stop lamp.

5. If there is normal, remove the stop lamp switch and then install again.

### - Inspection

## 1. Fuse Inspection

Mount the test fuse to the switch fuse and relay fuse part to confirm a normal joint fit.

Click to see large image...

Click to see large image...

## 2. GDS Data Analysis

1. Analyze GDS data and confirm if there is anything wrong with the stop lamp switch.
   (1) Connect the GDS to the self-diagnosis connector.

   (2) Turn the spark switch on

   (3) Step on the brake pedal.

   (4) Inspect the "brake switch" category that displays the "sensor data" GDS.

   **Normal waveform :**The pressure sensor signal value will change according to the brake ON/OFF switch.

Click to see large image...

## 3. Inspection Of Connector By Each Part

Check to see whether or not each connector has been damaged, or terminal surge, or incomplete connection has taken place
**[Engine Room Junction Box]**

Click to see large image...

**[ABS/VDC Control Module]**

Click to see large image...

## 4. Inspect The Stop Lamp Circuit

Connect probe to each terminal wire and confirm oscilloscope waveform.
**[Stop Lamp Switch Input / Output]**

Click to see large image...

**[Oscilloscope Waveform Screen]**

Click to see large image...

### - Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the lower crash pad.
   (Refer to Body - "Crash Pad")
3. Disconnect the stop lamp switch connector (A).

Click to see large image...

4. Pull the locking plate (A) as indicated by the arrow.

Click to see large image...

5. Turn stop lamp switch (A) 45° counterclockwise and remove it.

Click to see large image...

6. Inspect a removed stop lamp switch along the below procedures.
   (1) Confirm a normal connection with terminal part
      A confirmation can be made to see if the connector has been secured properly and if a connection mark is present.

Click to see large image...

(2) Perform the inspection of parts resistance

Click to see large image...

| Resistance (Ω) | 3-4 | 1-2 |
|---|---|---|
| Non rod protruded<br>(switch turned OFF) | Infinite | 0 |
| Rod protruded<br>(switch turned On) | 0 | Infinite |

## - Installation

1. Fix the brake pedal arm and insert fully the stop lamp switch as hiding contact part.

Click to see large image...

2. After inserting, turn the stop switch (A) 45° clockwise, and then assemble locking plate by pushing.

Click to see large image...

3. Confirm the gap between stop lamp switch and bracket.

**Stop lamp clearance (A)**: 1.0 - 2.0 mm (0.04 - 0.08 in.)

Click to see large image...

**NOTICE**

- If the gap between stop lamp switch and bracket is not 1.0-2.0mm (0.04-0.08in), perform the above process again.

4. Connect the stop lamp switch connector (A).

Click to see large image...

5. Install the lower crash pad.
   (Refer to Body - "Crash Pad")

## Brake System

## - Troubleshooting

1. Part diagnosis

| Items | Cause | Symptom | |
|---|---|---|---|
| | | – DTC Code : P0504<br>– | |

| | | | |
|---|---|---|---|
| Switch fuse | Faulty fuse connection, Damaged fuse | Symptom : Shifting gear trouble, Starting failure, Cruise control function cancelation trouble, EPB function cancelation trouble, Stop lamp lighting trouble, ESP OFF light illuminated. | |
| Relay fuse | Faulty fuse connection, Damaged fuse | – DTC Code : P0504<br>– Symptom : Shifting gear trouble, Starting failure, Cruise control function cancelation trouble, EPB function cancelation trouble, Stop lamp lighting trouble , ESP OFF light illuminated. | |
| Stop lamp switch | • Damaged wiring of each part<br>• Faulty connection to connector<br>• Each part is defective | – DTC Code : P0504<br>– Symptom : Shifting gear trouble, Starting failure, Cruise control function cancelation trouble, EPB function cancelation trouble, Stop lamp lighting trouble , ESP OFF light illuminated. | ① A waveform inspection is performed using an oscilloscope on each part during vehicle acceleration/braking. (Refer to stop lamp switch circuit inspection procedures)<br><br>② Refer to the relevant repair procedures of the part when something abnormal is discovered in the waveform (Refer to the repair procedures of the relevant part and if necessary replace it) |
| Stop signal electronic module (If it applies) | | – DTC Code : P0504, C2130, C2131<br>– Symptom : Shifting gear trouble, Starting failure, Cruise control function cancelation trouble, EPB function cancelation trouble, Stop lamp lighting trouble , ESP OFF light illuminated. | |
| Engine control module (ECM) | | – DTC Code : P0504<br>– Symptom :Shifting gear trouble,Cruise control function cancelation trouble | |
| Body control module (BCM) | | – Shifting gear trouble | |
| Shift-lock solenoid | | – Shifting gear trouble | |
| Inhibitor switch | | – Symptom : Shifting gear trouble, Starting failure, Cruise control function cancelation trouble, EPB function cancelation trouble | |
| Smart Key Unit (SMK) | | – Starting failure | |
| Electronic parking brake | | – Symptom : EPB function cancelation trouble , ESP OFF light illuminated. | |
| ABS/VDC control module (Pressure sensor) | | – Symptom : ESP OFF light illuminated. | |

2. Symptom diagnosis

| Symptom | Part that could be the cause | |
|---|---|---|
| Trouble starting | Switch fuse, Relay fuse, Stop lamp switch, Stop signal electronic module, ABS/VDC control module, Each wire, Connector | ① Inspect waveform using an oscilloscope on each part during vehicle acceleration/braking. (Refer to stop lamp switch circuit |

| | | |
|---|---|---|
| Trouble shifting gears | Switch fuse, Relay fuse, Stop lamp switch, Stop signal electronic module, BCM, ECM, Inhibitor switch, Each wire, Connector | switch circuit inspection Procedures)<br><br>② Refer to the relevant repair procedures of the part when something abnormal is discovered in the waveform (Refer to the repair procedures of the relevant part and if necessary replace it) |
| ESP OFF light illuminated | Switch fuse, Relay fuse, Stop lamp switch, Stop signal electronic module, ABS/VDC control module, Each wire, Connector | |
| P0504 | Switch fuse, Relay fuse, Stop lamp switch, Stop signal electronic module, ECM, Each wire, Connector | |
| Stop lamp does notworking | Switch fuse, Relay fuse, Stop lamp switch, Stop signal electronic module, Wire/Connector disconnected | |
| Stop lamp always turns on | Stop lamp switch, Stop signal electronic module, Wiring short circuit, Damaged fuse | |

3. Stop lamp switch system diagnosis

Click to see large image...

Click to see large image...

SSEM : Stop Signal Electronic Module

4. Refer to DTC guide when the related DTC codes are displayed.



## - Description

The electronic parking brake (EPB) is different from existing parking systems which operated with the brake pedal or the lever type. The EPB system sends the signal to the ECU when a driver operates the EPB switch. The ECU operates the EPB actuator composed with motor gears. The braking power is caused by occurs when the motor pulls the cable connected the brake system.

The EPB ECU is one of the parts of EPB system. It perceives the signal of the various sensor of system, executes a self diagnosis, controls EPB system with the logic.

## Main function

1. Static Braking Mode

   The operation and the cancellation at the stop condition of the vehicle

   (1) The operation condition: Pull the EPB switch irrespective of the brake pedal pressed condition. (Pull).

   – The Vehicle speed <= 3kph

   (2) The cancellation condition: Push the EPB switch at the ignition switch on & the brake pedal pressed condition. (Push).

2. Dynamic Braking Function

   Dynamic Braking Function (DBF) : The DBF is the braking function at the driving condition, it can operate the EPB system and cancel it at the vehicle driving condition. This function will be used while foreign materials get in between the brake pedal or the brake hydraulic line can not be operated.

   (1) The operation condition

   It operated only when the vehicle speed is faster than 3kph and the EPB switch is pushed.

   (2) The cancellation condition: It canceled when the pulling of the EPB switch is stopped.

   (3) Principle of Operation

   – ESP system is normal condition: EPB requests applying pressure of brake to ESP system.

   – ESP system is abnormal condition: EPB operates the parking brake for reduction of speed.

   (4) Peculiarity

   Anti-lock is operated when occurring wheel lock. Parking lamp on the cluster illuminates in the case of emergency braking.

3. Latching Run

   This is reconnection function to operate EPB normally after emergency release.

   Operation

   (1) After emergency release, when operating EPB first, the hook connects to the claw in the EPB with operating parking brake with maximum cable tension.

   (2) Reconnection function can be performed with the GDS.

   (3) After testing for reconnection 5 times, EPB isn't be operated in the present ignition switch cycle when EPB doesn't reconnect normally.

4. Bedding Mode

   You must do "Bedding in process" for optimizing the initial operation performance of EPB after replacing the parking brake shoe and rear brake disc.

   Bedding in Process

   (1) Ignition on, start engine.

   (2) Apply the foot brake 2 times within 10 seconds and hold applied after the last application.

   (3) Apply the EPB switch 4 times, followed by 3 release applications within 10 seconds.

   (4) The linings must be bedded-in by 6 repeated dynamic braking procedures from 30-35 km/h to vehicle standstill. (If the vehicle speed is over 50 km/h at the Bedding Mode, it is automatically released.)

   (5) After each braking cycle a cooling period for the linings is necessary to prevent lining damage.

   – The cooling can either be carried out via driving a 500 m distance after each braking cycle without any apply of the EPB or via keeping the vehicle in standstill for 1 minute after each braking.

5. AVH (Automatic Vehicle Hold)

   AVH supports to keep a stop condition of the vehicle by hydraulic brake at a stop.

   (1) Condition for operation

– Engine run
– AVH switch ON.
– Closing driver door
– Fastening driver seat belt
– A gear shift is not P-range
– Perfect stop condition with hitting the brake pedal.

(2) AVH function holds stop condition of the vehicle for maximum 5 minutes.
VDC valve keeps stop condition because of intercept the oil passage with pressure occurred from brake pedal.

(3) An accumulated time of AVH operation : Max. 30min

(4) Automatic release function
AVH mode is released when driver attempts starting a vehicle by pedaling an acceleration pedal at the D/ S/ R range.

(5) Automatically convert AVH to EPB
AVH will convert EPB operation automatically if any one satisfy conditions below.
[Normal conversion case]
– In the case of driver door open & Driver seat belt release at the same time
– In the case of opening the hood while the shift lever is D or S.
– In the case of opening the trunk while the shift lever is R
– In the case of over 5 minutes of AVH operation time
– Stop at a slope of twenty five degrees
[Abnormal conversion case]
– When sensing detailed motion of the vehicle.
– When sensing the fault of ESP hydraulic system.

## Warning Lamp

Click to see large image...

1. EPB warning lamp

   EPB warning lamp indicates the EPB cut and malfunction.

   EPB warning lamp comes ON below cases.

   (1) EPB warning lamp comes on for 3 seconds after the ignition switch is ON. If EPB system is working properly, EPB warning lamp goes OFF

   (2) If EPB system is not working properly, EPB warning lamp comes ON

   (3) Under diagnosis mode, EPB warning lamp comes ON

2. AUTO HOLD lamp / AUTO HOLD function lamp

(1) AUTO HOLD switch ON

A. Brake system operates automatically when vehicle speed is "0", in the case of parking or waiting at a red light, during braking (AUTO HOLD function lamp : Green)

B. Brake system is released automatically when step on the accelerator pedal. (AITO HOLD lamp : White)

(2) AUTO HOLD switch OFF : AUTO HOLD function does not operate.



## - Components

Click to see large image...

1. ESP Control Module (HECU)
2. EPB Switch
3. Electronic Parking Brake (EPB) actuator



## - Circuit Diagram

Click to see large image...

## - Terminal Function

Click to see large image...

| Pin No | Fuction | Pin No | Fuction |
|---|---|---|---|
| 6 | Electrical parking brake signal 1 | 2 | Rear right EPB motor power |
| 7 | Electrical parking brake signal 2 | 3 | Rear right EPB motor ground |
| 8 | Electrical parking brake signal 3 | 12 | Rear left EPB motor ground |
| 9 | Electrical parking brake signal 4 | 13 | Rear left EPB motor power |



## - Removal

**⚠ CAUTION**

- Be careful not to damage the parts located under the vehicle (floor under cover, fuel filter, fuel tank and canister) when raising the vehicle using the lift.
  (Refer to General Information - "Lift and Support Points")

## [EPB Switch]

1. Turn ignition switch off and disconnect the battery (-) cable from the battery.
2. Remove the crash pad lower pannel.
   (Refer to Body - " Crash Pad Lower Pannel")
3. Loosen the guide screw and then removing the EPB switch (A).

Click to see large image...

## [EPB Actuator]

1. Turn ignition switch off and disconnect the battery (-) cable from the battery.
2. Remove the rear wheel and tire.
3. Remove the EPB actuator from rear caliper.
   (Refer to Brake System - "Rear Disc Brake")

## - Components

Click to see large image...

1. ABS Control module (HECU)
2. Front wheel speed sensor
3. Rear wheel speed sensor
4. ABS Warning lamp
5. Parking brake/ EBD warning lamp



## - Description of ESP

ESP recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention.

ESP adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and ESP functions. Whereas the ABS/TCS function controls wheel slip during braking and acceleration and, thus, mainly intervenes in the longitudinal dynamics of the vehicle, active yaw control stabilizes the vehicle about its vertical axis.

This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.

ESP essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.

The stability control feature works under all driving and operating conditions. Under certain driving conditions, the ABS/TCS function can be activated simultaneously with the ESP function in response to a command by the driver.

In the event of a failure of the stability control function, the basic safety function, ABS, is still maintained.

Click to see large image...

## Description of ESP Control

ESP system includes ABS/EBD, TCS and AYC function.

ABS/EBD function : The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square wave. By using the input of above signals, the ECU calculates the vehicle speed and the acceleration & deceleration of the four wheels. And, the ECU judges whether the ABS/EBD should be actuated or not.

TCS function prevents the wheel slip of drive direction by adding the brake pressure and engine torque reduction via CAN communication. TCS function uses the wheel speed sensor signal to determine the wheel slip as far as ABS function.

AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).

If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and send engine torque reduction signal by CAN.

After the key-on, the ECU continually diagnoses the system failure. (self-diagnosis)If the system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESP warning lamp. (fail-safe warning)

Click to see large image...

## Input and Output Diagram

Click to see large image...

## - ESP Operation Mode

1. STEP 1
   The ESP analyzes the intention of the driver.

Click to see large image...

2. STEP 2
   It analyzes the movement of the ESP vehicle.

Click to see large image...

3. STEP 3

   The HECU calculates the required strategy, then actuates the appropriate valves and sents torque control requests via CAN to maintain vehicle stability.

Click to see large image...

**ESP Hydraulic System Diagram**

1. ESP Non-operation : Normal braking.

| Solenoid Valve | Continuity | Valve | Motor Pump | TC Valve |
|---|---|---|---|---|
| IN (NO) | OFF | OPEN | OFF | OFF |
| OUT (NC) | OFF | CLOSE | | |

2. ESP operation

| Solenoid Valve | | Continuity | Valve | Motor Pump | TC Valve |
|---|---|---|---|---|---|
| Understeering | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| (Only inside of rear wheel) | IN (NO) | OFF | OPEN | ON | ON |
| | OUT (NC) | OFF | CLOSE | | |
| Oversteering (Only outside of front wheel) | IN (NO) | OFF | OPEN | | |
| | OUT (NC) | OFF | CLOSE | | |

## Warning Lamp Control

Click to see large image...

## ABS Warning Lamp module

The active ABS warning lamp module indicates the self-test and failure status of the ABS. The ABS warning lamp shall be on :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ABS functions by failure.
- During diagnostic mode.
- When the ECU Connector is seperated from ECU.
- Cluster lamp is ON when communication is impossible with CAN module.

## EBD/Parking Brake Warning Lamp Module

The active EBD warning lamp module indicates the self-test and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shallbe on :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the Parking Brake Switch is ON or brake fluid level is low.
- When the EBD function is out of order .
- During diagnostic mode.
- When the ECU Connector is seperated from ECU.
- Cluster lamp is ON when communication is impossible with CAN module.

## ESP Function / Warning Lamp (ESP System)

The ESP function/warning lamp indicates the self-test and failure status of the ESP.
The ESP function/warning lamp is turned on under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the ESP function is inhibited by system failure.
- When the ESP control is operating. (Blinking - 2Hz)
- During diagnostic mode.(Except standard mode)
- Cluster lamp is ON when communication is impossible with CAN module.

## ESP OFF Lamp (ESP System)

The ESP Off lamp indicates the self-test and operating status of the ESP.
The ESP Off lamp operates under the following conditions :

- During the initialization mode after IGN ON. (continuously 3 seconds).
- ESP Off lamp is On when driver input the ESP Off switch.

## ESP ON / OFF Switch (ESP System)

The ESP On/Off Switch shall be used to toggle the ESP function between On/Off states based upon driver input.
The On/Off switch shall be a normally open, momentary contact switch.Closed contacts switch the circuit to ignition.
Initial status of the ESP function is on and switch toggle the state.



### - Circuit Diagram

Click to see large image...

- Terminal Function

Click to see large image...

| PIN No | Desciption | Current | |
|---|---|---|---|
| | | Max | Min |
| 1 | Voltage supply for pump motor | 39A | 10 MΩ |
| 2 | RR EPB motor power | 30A | 10 MΩ |
| 3 | RR EPB motor ground | 30A | 10 MΩ |
| 4 | Clutch stroke sensor signal | - | - |
| 5 | Local CAN High | 30 mA | - |
| 6 | Electric parking brake signal 1 | 20 mA | 250 MΩ |
| | | | |

| | | | |
|---|---|---|---|
| 7 | Electric parking brake signal 2 | 20 mA | 250 MΩ |
| 8 | Electric parking brake signal 3 | 20 mA | 250 MΩ |
| 9 | Electric parking brake signal 4 | 20 mA | 250 MΩ |
| 10 | - | - | 250 MΩ |
| 11 | - | - | - |
| 12 | RL EPB motor ground | 30A | - |
| 13 | RL EPB motor power | 30A | 10 MΩ |
| 14 | Ground for solenoid valves and ECU | 30A | 10 MΩ |
| 15 | - | - | 10 MΩ |
| 16 | - | - | 250 MΩ |
| 17 | ESP OFF switch signal | 16.8 mA | |
| 18 | N' Signal | - | 250 MΩ |
| 19 | Local CAN High | 10 mA | 250 MΩ |
| 20 | Local CAN Low | 30 mA | 250 MΩ |
| 21 | - | - | 250 MΩ |
| 22 | P-CAN LOW | - | |
| 23 | P-CAN High | 200 mA | 250 MΩ |
| 24 | - | - | 250 MΩ |
| 25 | Wheel speed sensor supply voltage (RL) | 16.8 mA | |
| 26 | Wheel speed sensor supply voltage (RR) | 16.8 mA | 250 MΩ |
| 27 | Wheel speed sensor supply voltage (FR) | 16.8 mA | 250 MΩ |
| 28 | Wheel speed sensor supply voltage (FL) | - | 250 MΩ |
| 29 | - | 16.8 mA | 250 MΩ |
| 30 | Voltage supply for solenoid valves | 30A | |
| 31 | - | - | 10 MΩ |
| 32 | - | Open drain | |
| 33 | - | - | |
| 34 | Auto holding ON/OFF switch signal | 10 mA | |
| 35 | Brake light switch | 10 mA | 250 MΩ |
| 36 | HAC / BLA signal output | 16.8 mA | 250 MΩ |
| 37 | IGN 1 | 5A | 250 MΩ |
| 38 | ESS signal output | 16.8 mA | 50 MΩ |
| 39 | - | 16.8 mA | 250 MΩ |
| 40 | - | - | |
| 41 | - | - | |
| 42 | - | - | 250 MΩ |
| 43 | - | - | 250 MΩ |
| 44 | Wheel speed sensor ground (FL) | 30 mA | 250 MΩ |
| 45 | Wheel speed sensor ground (FR) | 30 mA | 250 MΩ |
| 46 | Recirculation pump ground | 40A | 250 MΩ |



## - Failure Diagnosis

1. In principle, ESP and TCS controls are prohibited in case of ABS failure.
2. When ESP or TCS fails, only the failed system control is prohibited.

3. However, when the solenoid valve relay should be turned off in case of ESP failure, refer to the ABS fail-safe.
4. Information on ABS fail-safe is identical to the fail-safe in systems where ESP is not installed.

## Memory of Fail Code

1. It keeps the code as far as the backup lamp power is connected. (O)
2. It keeps the code as far as the HCU power is on. (X)

## Failure Checkup

1. Initial checkup is performed immediately after the HECU power on.
2. Valve relay checkup is performed immediately after the IG2 ON.
3. It executes the checkup all the time while the IG2 power is on.

## Countermeasures in Fail

1. Turn the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Stop the control during the operation and do not execute any until the normal condition recovers.

## Warning Lamp ON

1. ESP warning lamp turn on for 3sec after IGN ON.
2. ESP function lamp blinks when ESP Act.
3. If ESP fail occured, ESP warning turns ON.
4. ESP OFF lamp turn on in case of
   - ESP Switch OFF
   - 3sec after IGN ON

## Standard Flow of Diagnostic Troubleshooting

Click to see large image...

## Notes With Regard to Diagnosis

The phenomena listed in the following table are not abnormal.

| Condition | Explanation |
|---|---|
| System check sound | When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed. |
| ABS operation sound | 1) Sound of the motor inside the ABS hydraulic unit operation (whine).<br>2) |

| | |
|---|---|
| | Sound is generated along with vibration of the brake pedal (scraping).<br>3) When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release (Thump : suspension; squeak : tires) |
| ABS operation (Long braking distance) | For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed. |

Inspection method

With the IGN OFF, set the IGN to ON position : If the ABS/Brake Warning Light illuminates and distinguishes after 3 seconds, the warning lamp and ABS system are all normal.

1. If the Warning Light does not illuminate when IGN is set to ON position
   (1) Remove the ABS ECU connecter (located in the engine room).
   (2) Set the IGN to ON position.
   (3) If the ABS/Brake Warning Light does not illuminate: The failure is related to the Warning Light. Check the instrument cluster and wiring.
   (4) If the ABS/Brake Warning Light illuminates and stays on :

   The Warning Light is normal and judged to be failure of the VDC system. Inspect the VDC system using GDS.
2. If the Warning Light does not distinguish after its illumination when IGN is set to ON position.
   (1) Self-diagnose using GDS.
   (2) Record fault code.
   (3) Self-diagnose after erasing the fault code.
   (4) If the result of self-diagnosis is normal after erasing the fault code :
   Set the IGN to OFF, then to ON position and check whether the Warning Light operates normally.
   (5) If the result of self-diagnosis continues to display error after erasing the fault code :
   Check according to the inspection sheet of the fault code.
3. Even if the Warning Light and VDC system are all normal, erase all the memorized fault codes using GDS (if there is no memorized fault code, record the fault code).

**⚠ CAUTION**

1) When removing or engaging all the connectors set the IGN to OFF position.
2) During the driving test, record on the inspection sheet when the Warning Light illuminates or every time any event is occurred.

## ABS Check Sheet

Click to see large image...

## Problem Symptoms Table

| Symptom | Suspect Area |
|---|---|
| ABS does not operate. | Only when 1 - 4 are all normal and the problem is still occurring, replace the HECU.<br>1) Check the DTC reconfirming that the normal code is output.<br>2) Power source circuit.<br>3) Speed sensor circuit.<br>4) Check the hydraulic circuit for leakage. |
| | |

| | |
|---|---|
| ABS does not operate intermittently. | Only when 1 - 4 are all normal and the problem is still occurring, replace the ABS actuator assembly.<br>1) Check the DTC reconfirming that the normal code is output.<br>2) Wheel speed sensor circuit.<br>3) Stop lamp switch circuit.<br>4) Check the hydraulic circuit for leakage. |
| Communication with GDS is not possible. (Communication with any system is not possible) | 1) Power source circuit<br>2) CAN line |
| Communication with GDS is not possible. (Communication with ABS only is not possible) | 1) Power source circuit<br>2) CAN line<br>3) HECU |
| When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up. | 1) ABS warning lamp circuit<br>2) HECU |
| Even after the engine is started, the ABS warning lamp remains ON. | 1) ABS warning lamp circuit<br>2) HECU |

**⚠ CAUTION**

- During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.
- Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.

Click to see large image...

## Detecting condition

| Trouble Symptoms | Possible Cause |
|---|---|
| Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ESP control module. | – Faulty power source circuit<br>– Faulty wheel speed sensor circuit<br>– Faulty hydraulic circuit for leakage<br>– Faulty HECU |

## Inspection procedures

**DTC Inspection**

1. Connect the GDS with the data link connector and turn the ignition switch ON.
2. Verify that the DTC code is output.
3. Is the DTC code output?

Check the power source circuit.

Erase the DTC and recheck using GDS.

## Check the power source circuit

1. Disconnect the connector from the ESP control module.
2. Turn the ignition switch ON, measure the voltage between terminal 29 of the ESP control module harness side connector and body ground.

   **Specification :**approximately B+

   Is the voltage within specification?

Check the ground circuit.

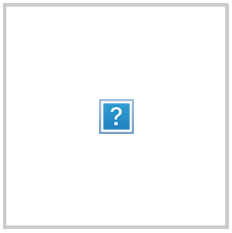
Check the harness or connector between the fuse (7.5A) in the engine compartment junction block and the ESP control module. Repair if necessary.

Click to see large image...

## Check the ground circuit

1. Disconnect the connector from the ESP control module.
2. Check for continuity between terminals 13, 38 of the ESP control module harness side connector and ground point.
   Is there continuity?

   Check the wheel speed sensor circuit.



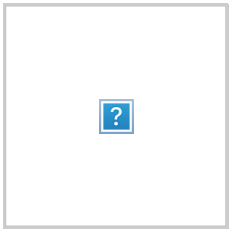
Repair an open in the wire and ground point.

Click to see large image...

## Check the wheel speed sensor circuit

1. Refer to the DTC troubleshooting procedures.
2. Is it normal?

Check the hydraulic circuit for leakage.



Repair or replace the wheel speed sensor.

## Check the hydraulic circuit for leakage

1. Inspect leakage of the hydraulic lines.
2. Is it normal?

The problem is still occurring, replace the ESP control module.

Repair the hydraulic lines for leakage.

Click to see large image...

## Detecting condition

| Trouble Symptoms | Possible Cause |
|---|---|
| Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ESP control module. | – Faulty power source circuit<br>– Faulty wheel speed sensor circuit<br>– Faulty hydraulic circuit for leakage<br>– Faulty HECU |

## Inspection procedures

**DTC Inspection**

1. Connect the GDS with the data link connector and turn the ignition switch ON.
2. Verify that the DTC code is output.
3. Is the DTC code output?

Check the wheel speed sensor circuit.

Erase the DTC and recheck using GDS.

## Check the wheel speed sensor circuit

1. Refer to the DTC troubleshooting procedures.
2. Is it normal?

Check the stop lamp switch circuit.

Repair or replace the wheel speed sensor.

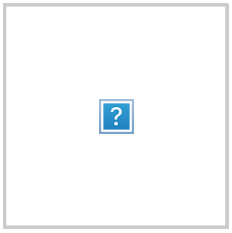
## Check the stop lamp switch circuit

1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.
2. Measure the voltage between terminal 23 of the ESP control module harness side connector and body ground when brake pedal is depressed.

**Specification :**approximately B+

Is the voltage within specification?

Check the hydraulic circuit for leakage.



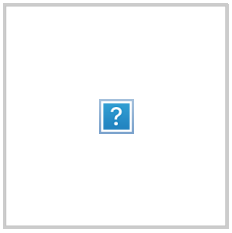
▶ Repair the stop lamp switch. Repair an open in the wire between the ESP control module and the stop lamp switch.

Click to see large image...

## Check the hydraulic circuit for leakage

1. Refer to the hydraulic lines.
2. Inspection leakage of the hydraulic lines.
3. Is it normal?

▶ The problem is still occurring, replace the ESP control module.



Repair the hydraulic lines for leakage.

Click to see large image...

## Detecting condition

| Trouble Symptoms | Possible Cause |
|---|---|
| Possible defect in the power supply system (including ground) for the diagnosis line. | – An open in the wire<br>– Poor ground<br>– Faulty power source circuit |

## Inspection procedures

**Check The Power Supply Circuit For The Diagnosis**

1. Measure the voltage between terminal 16 of the data link connector and body ground.

   **Specification :**approximately B+

   Is voltage within specification?

Check the ground circuit for the diagnosis.

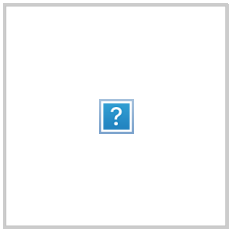
Repair an open in the wire. Check and replace fuse from the engine compartment junction block.

Click to see large image...

## Check the ground circuit for the diagnosis

1. Check for continuity between terminal 4 of the data link connector and body ground.
   Is there continuity?

   Repair an open in the wire between terminal 4 of the data link connector and ground point.



Click to see large image...

Click to see large image...

## Detecting condition

| Trouble Symptoms | Possible Cause |
|---|---|
| When communication with GDS is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit. | – An open in the wire<br>– Faulty HECU<br>– Faulty power source circuit |

## Inspection procedures

**Check for Continuity in the CAN Line**

1. Disconnect the connector from the ESP control module.
2. Check for continuity between terminals 26, 14 of the ESP control module connector and 3, 11 of the data link connector.
3. Is there continuity?

Check the power source of ESP control module.

Repair an open in the wire.

## Check the power source of ESP control module

1. Disconnect the connector from the ESP control module.
2. Turn the ignition switch ON, measure the voltage between terminal 29 of the ESP control module harness side connector and body ground.

**Specification :**approximately B+

Is voltage within specification?

Check for poor ground.

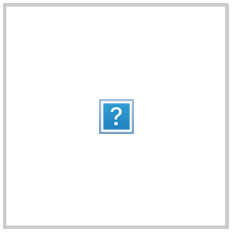
Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ESP control module.Repair if necessary.

Click to see large image...

## Check for poor ground

1. Check for continuity between terminal 4 of the data link connector and ground point.
2. Is the electric current applied between groundings?

Replace the ESP control module and recheck.



Repair an open in the wire or poor ground

Click to see large image...

Click to see large image...

## Detecting condition

| Trouble Symptoms | Possible Cause |
|---|---|
| When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check. Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the faulty HECU. | – Faulty ABS warning lamp bulb<br>– Blown fuse is related to ABS in the engine compartment junction block<br>– Faulty ABS warning lamp damaged<br>– Faulty ABS warning lamp module |

| | |
|---|---|
| | – Faulty HECU |

## Inspection procedures

**Problem verification**

1. Disconnect the connector from the ESP control module and turn the ignition switch ON.
2. Does the ABS warning lamp light up?

Inspectagain after replacing the ESP HECU.

Check the power source for the ABS warning lamp.

## Check the power source for the ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and turn the ignition switch ON.
2. Measure the voltage between terminal (M08) 39 of the cluster harness side connector and body ground.

**Specification :**approximately B+

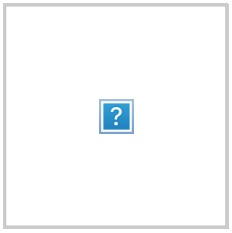
Click to see large image...

3. Is voltage within specification?



Check the CAN circuit resistance for ABS warning lamp.

Check for blown fuse.



## Check the CAN circuit resistance for ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and turn the ignition switch OFF.
2. Measure the resistance between terminal (M08) 32 and 33 of the cluster harness side connector.

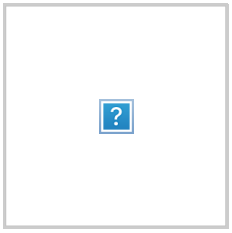
**Specification :**60Ω

Click to see large image...

3. Is resistance within specification?

Repair ABS warning lamp bulb or instrument cluster assembly.

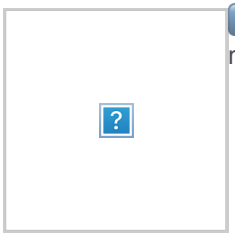
Check the CAN circuit wiring for ABS warning lamp.



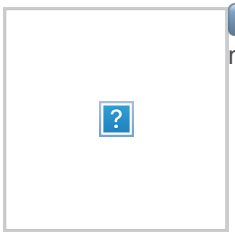
## Check the CAN circuit wiring for ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and ESP HECU connector, and then turn the ignition switch OFF.
2. Check for continuity between terminal (M08) 32 of the cluster harness side connector and terminal 26 of ESP HECU harness side.
   Check for continuity between terminal (M08) 33 of the cluster harness side connector and terminal 14 of ESP HECU harness side.

   **Specification :**Below 1Ω
3. Is resistance within specification?



▶ Repair short of wiring between terminal 26, 14 of ESP HECU harness connector and ABS warning lamp module.



▶ Repair open of wiring between terminal 26, 14 of ESP HECU harness connector and ABS warning lamp module.

Click to see large image...

## Detecting condition

| Trouble Symptoms | Possible Cause |
|---|---|
| If the HECU detects trouble, it lights the ABS warning lamp while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory. Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit. | – An open in the wire<br>– Faulty instrument cluster assembly<br>– Faulty ABS warning lamp module<br>– Faulty HECU |

## Inspection procedures

**Check DTC Output**

1. Connect the GDS to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using GDS.
3. Is DTC output?

Perform the DTC troubleshooting procedure (Refer to DTC troubleshooting).

Check the CAN circuit resistance for ABS warning lamp.

## Check the CAN circuit resistance for ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and turn the ignition switch OFF.
2. Measure the resistance between terminal (M08) 32 and 33 of the cluster harness side connector.

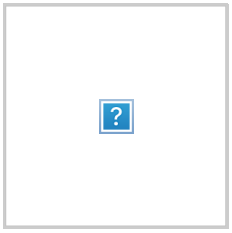
**Specification :**60Ω

Click to see large image...

3. Is resistance within specification?

Repair ABS warning lamp bulb or instrument cluster assembly.

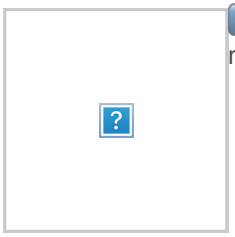
Check the CAN circuit wiring for ABS warning lamp.



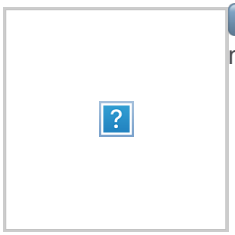
## Check the CAN circuit wiring for ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and ESP HECU connector, and then turn the ignition switch OFF.
2. Check for continuity between terminal (M08) 32 of the cluster harness side connector and terminal 26 of ESP HECU harness side.
   Check for continuity between terminal (M08) 33 of the cluster harness side connector and terminal 14 of ESP HECU harness side.

   **Specification :**Below 1Ω
3. Is resistance within specification?



▶ Repair short of wiring between terminal 26, 14 of ESP HECU harness connector and ABS warning lamp module.



▶ Repair open of wiring between terminal 26, 14 of ESP HECU harness connector and ABS warning lamp module.



- Components

Click to see large image...

1. Front - right (FR)
2. Rear - left (RL)
3. Rear - right (RR)
4. Front - left (FL)
5. MC2
6. MC1
7. ESP control module (HECU)
8. Bracket



## - Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. In the case of G 3.5 MPI, G3.8 GDI vehicle, removing the variable intake solenoid (VIS) actuator.
   (Refer to Engine Mechanical System - "Variable Intake Solenoid (VIS) Actuator")
3. Pull up the lock of the HECU connector and then disconnect the connector (A).

Click to see large image...

4. Separate the brake tubes from the HECU by unlocking the nuts (6-ea) couterclockwise using a spanner.

**Tightening torque :**
13.7 - 16.7 N.m (1.4 - 1.7 kgf.m, 10.1 - 12.3 lb-ft)

Click to see large image...

**Tightening torque :**

18.6 - 22.6 N.m (1.9 - 2.3 kgf.m, 13.7 - 16.6 lb-ft)

Click to see large image...

5. Loosen the ESP control module mounting nut (A) and then remove the ESP control module from the vehicle.

**Tightening torque :**
16.7 - 25.5 N.m (1.7 - 2.6 kgf.m, 12.3 - 18.8 lb-ft)

Click to see large image...

6. Separate the bracket (B) after remove the mounting bolt from the HECU (A).

Click to see large image...

## - Installation

1. To install, reverse the removal procedure.
2. After installation, bleed the brake system.
   (Refer to ESP(Electronic Stability Program) System - "ESP System Bleeding")
3. Connect the GDS to the data link connector located underneath the dash panel.
4. Conduct the Variant coding.
5. Conduct the Auto Detected Sensor Calibration.

6. Conduct the Longitudinal G Sensor Calibration.
7. After replacing the ESP control module execute the "Assembly Check (ECU replacement)" of the additional function to check that the mounting is successful.

### - Adjustment

Perform diagnostic procedure by using diagnostic device as shown below :

1. Connect self-diagnosis connector (16pins) located under the driver side crash pad to self-diagnosis device, and then turn the self-diagnosis device after key is ON.
2. Select the "vehicle model" and "ESP/ESC" on GDS vehicle selection screen, then select OK.

## [Variant Code Reset]

Click to see large image...

## [Variant Coding]

Click to see large image...

Click to see large image...

## [Longitudinal G Sensor Calibration]

Click to see large image...

## Assembly Check (ECU replacement)

Click to see large image...

Brake System

## - Description

1. The ESP OFF switch is for the user to turn off the ESP system.
2. The ESP OFF lamp is on when ESP OFF switch is engaged.

Brake System

## - Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the crash pad lower panel.
   (Refer to Body - "Crash Pad")
3. Remove the side air vent duct [LH] (A).

Click to see large image...

4. Loosen the guide screw and then removing the ESP OFF switch (A).

Click to see large image...

5. Check for continuity between the terminals. If the continuity is not as specified, replace the ESP OFF switch.

Click to see large image...

Click to see large image...

## - Installation

1. To install, reverse the removal procedures.



## - Components

Click to see large image...

1. Front wheel speed sensor
2. Front wheel speed sensor connector



## - Removal

**⚠ CAUTION**

- Be careful not to damage the parts located under the vehicle (floor under cover, fuel filter, fuel tank and canister) when raising the vehicle using the lift.

(Refer to General Information - "Lift and Support Points")

1. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire (A) from front hub.

**Tightening torque :**
107.9 - 127.5 N.m (11.0 - 13.0 kgf.m, 79.6 - 94.0 lb-ft)

**NOTICE**

- Be careful not to damage the hub bolts when removing the front wheel and tire (A).

Click to see large image...

3. Remove the front wheel guard.
   (Refer to Body - "Front Wheel Guard")
4. Disconnect the front wheel speed sensor connector (A) and then remove the fixing clip (B).

Click to see large image...

5. Remove the front wheel speed sensor cable braket bolt (A).

**Tightening torque :**
19.6 - 29.4N.m (2.0 - 3.0 kgf.m, 14.5 - 21.7 lb-ft)

Click to see large image...

6. Loosen the bolt and then disconnect the front wheel speed sensor (A).

**Tightening torque :**
6.9 - 10.8 N.m (0.7 - 1.1 kgf.m, 5.1 - 8.0 lb-ft)

Click to see large image...

### - Installation

1. To install, reverse the removal procedure.

### - Inspection

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

**NOTICE**

- In order to protect the wheel speed sensor, when measuring output voltage, a 100Ω resister must be used as shown.

Click to see large image...

2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.

Click to see large image...

**V_low :**0.59V - 0.84V
**V_high :**1.18V - 1.68V
**Frequency range :**1 - 2,500 Hz



## - Components

**[2WD]**

Click to see large image...

1. Front wheel speed sensor

**[4WD]**

Click to see large image...

1. Rear wheel speed sensor
2. Rear wheel speed sensor connector



## - Removal

**⚠ CAUTION**

- Be careful not to damage the parts located under the vehicle (floor under cover, fuel filter, fuel tank and canister) when raising the vehicle using the lift.

(Refer to General Information - "Lift and Support Points")

## [2WD]

1. Turn the ignition switch OFF and then disconnect the negative (-) battery cable.
2. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.
3. Remove the rear wheel and tire (A) from the rear hub.

**Tightening torque :**
107.9 - 127.5 N.m (11.0 - 13.0 kgf.m, 79.6 - 94.0 lb-ft)

**NOTICE**

- Be careful not to damage the hub bolts when removing the rear wheel and tire (A).

Click to see large image...

4. Remove the rear brake caliper.
   (Refer to Brake System - "Rear Disc Brake")
5. Remove the rear brake disc (A).

Click to see large image...

6. Disconnect the rear wheel speed sensor connector (A).

Click to see large image...

7. Remove the hub assembly and dust cover (A) after loosening the mounting bolts.

**Tightening torque :**

98.1 - 117.7 N.m (10.0 - 12.0 kgf.m, 72.3 - 86.8 lb-ft)

Click to see large image...

## [4WD]

1. Turn the ignition switch OFF and then disconnect the negative (-) battery cable.
2. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.
3. Remove the rear wheel and tire (A) from the rear hub.

**Tightening torque :**
107.9 - 127.5 N.m (11.0 - 13.0 kgf.m, 79.6 - 94.0 lb-ft)

**NOTICE**

- Be careful not to damage the hub bolts when removing the rear wheel and tire (A).

Click to see large image...

4. Remove the rear wheel guard.
   (Refer to Body - "Rear Wheel Guard")
5. Disconnect the rear wheel speed sensor connecter (A).

Click to see large image...

6. Remove the rear wheel speed sensor cable bracket mounting bolt (A).

**Tightening torque :**
19.6 - 29.4N.m (2.0 - 3.0 kgf.m, 14.5 - 21.7 lb-ft)

Click to see large image...

7. Disconnect the EPB actuator connector (A).

Click to see large image...

8. Remove the rear wheel speed sensor (A) after loosening the mounting bolt.

**Tightening torque :**
6.9 - 10.8 N.m (0.7 - 1.1 kgf.m, 5.1 - 8.0 lb-ft)

Click to see large image...

## - Replacement

1. Remove the rear wheel hub bearing assembly.
   (Refer to Driveshaft and Axle - "Rear Hub - Carrier")
2. Fix the rear hub bearing assembly (A) on the vise.

**NOTICE**

- When fixing on the vise, use a cloth not to be damaged the hub bearing assembly.
- Be careful if excessive force for fixing on the vise may damage the hub bearing assembly.

Click to see large image...

3. Check the direction of the sensor cap (A).

Click to see large image...

4. Remove the sensor cap by hammering on a gap between sensor cap and hub bearing assembly using a scraper (A).

Click to see large image...

**NOTICE**

- In order to widen the gap little by little, hammering around the bearing cap 10-20 times.

Click to see large image...

- When removing the sensor cap, remove it in a straight direction not to damage the tone wheel or encoder.

Click to see large image...

5. Check if distorted or damaged the tone wheel or encoder (A).

Click to see large image...

**NOTICE**

- Check if damaged the tone wheel or encoder after removing the sensor cap and replace the hub bearing if it was deformed.
- If the tone wheel is deformed, it may trigger the MIL ON or other problems.

Click to see large image...

6. Position the sensor cap to the same direction of sensor cap connector (A) as you checked before removing.

Click to see large image...

**NOTICE**

- Before installing the sensor cap, do not let any foreign material and contaminant into the hub bearing (A) assembly.

Click to see large image...

7. Install the sensor cap (A) with the special service tool (09527-AL500).

Click to see large image...

**NOTICE**

- Hammer until there is no gap between the SST and hub bearing assembly and install the sensor cap.

Click to see large image...

- Be careful not to tilt to one side when installing the sensor cap as it may damage the tone wheel or encoder.
- When sensor cap installation, hammering it until the gap disappeared between the sensor cap and hub bearing assembly.

Click to see large image...

8. Install the rear wheel hub bearing assembly.
   (Refer to Driveshaft and Axle - "Rear Hub - Carrier")

### - Installation

1. To install, reverse the removal procedure.

### - Inspection

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

**NOTICE**

- In order to protect the wheel speed sensor, when measuring output voltage, a 100Ω resister must be used as shown.

Click to see large image...

2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.

Click to see large image...

**V_low :**0.59V - 0.84V
**V_high :**1.18V - 1.68V
**Frequency range :**1 - 2,000 Hz



## - Description

The yaw rate and G sensor is included inside the air bag control module (SRSCM).
When the vehicle is turning with respect to a vertical axis the yaw rate sensor detects the yaw rate electroniclly by the vibration change of plate fork inside the yaw rate sensor.

If yaw velocity reaches the specific velocity after it detects the vehicle'yawing, the ESC control is reactivated.
The later G sensor senses vehicle's lateral G. A small element inside the sensor is attached to a deflectable leverarm by later G.
Direction and magnitude of lateral G loaded to vehicle can be known with electrostatic capacity changing according to lateral G.

Click to see large image...

## - Specifications

| Description | Specification |
|---|---|
| Operating voltage | 8 - 16V |
| | |

| | | |
|---|---|---|
| Output signal | | CAN Interface |
| Operating temperature | | -40 - 85°C (-40 - 185°F) |
| Yaw-rate sensor | Measurement range | -128 to +128°/sec |
| | Frequency response | 15 - 45Hz |
| G sensor | Measurement range | -1.99 to +1.99g |
| | Frequency response | 50 Hz ± 60% |



## - Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.

> **WARNING**
> • Disconnect the battery negative cable and wait for at least thirty seconds before beginning work.

2. Remove the floor console.
   (Refer to Body - "Floor Console")
3. Pull up the lock, of the SRSCM connector, the disconnect the connector.

Click to see large image...

4. Remove the SRSCM mounting bolts (3EA) from the SRSCM, then remove the SRSCM.

**⚠ CAUTION**

- Disconnect the battery negative cable and wait for at least thirty seconds before beginning work.

Click to see large image...

## - Installation

1. To install, reverse the removal procedures.
2. Perform Longitudinal G-sensor calibration in vehicle S/W Management menu of the GDS.

## - Adjustment

As manual for diagnosis methods by using diagnosis device, the main contents are as follows:

1. Connect self-diagnosis connector (16pins) located in the lower of driver side crash pad to self-diagnosis device, and then turn the self-diagnosis device after key is ON.

2. Select the "vehicle model" and "ABS/ESP" on GDS vehicle selection screen, then select OK.

## [Longitudinal G Sensor Calibration]

Click to see large image...

## - Description

The DBC function is the acronym word of Downhill Brake Control function. When a vehicle goes down the hill, just pushing the DBC switch enables the car to keep its vehicle's speed at a constant value without operating the brake pedal. The DBC function is operated when the vehicle is on the decline and its velocity is under the predetermined speed.

## - Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the floor console upper cover.
   (Refer to Body - "Floor Console")
3. Remove the DBC switch (A) after loosening the screw.

Click to see large image...

## - Installation

1. To install, reverse the removal procedures.



## - Description

The Steering Angle Sensor (SAS) is installed in MDPS (Motor Driven Power Steering) and it sends messages to HECU through CAN communication line.

The SAS is used to determine turning direction and speed of the steering wheel.

The HECU uses the signals from the SAS when performing ESC-related calculations.

Components (Steering Angle Sensor, Torque Sensor, Failsafe relay, etc.) of the EPS system are located inside the steering column & EPS unit assembly and the steering column.

**⚠ CAUTION**

- Steering column & EPS unit assembly must not be disassemble to be inspected.



## - Description

– FCA system is designed to help avoid a potential collision or reduce its impact when drivers applies inadequate, delayed or no brakes at all to avoid a collision.

– The system detects the risk factors on the road by using the frontal impact sensor and warn the driver and activate the emergency brake to prevent collision or reduce collision speed.

1. Deactivation condition

| | |
|---|---|
| Normal deactivation by the driver | – FCA OFF<br>– VDC 2 OFF |
| Deactivation by the driver | When it exceeded the maximum operation speed.<br>When the shift lever is in R or P<br>When you pressed the accelerator pedal half way. |
| | When it detected driver's action to avoid a collision such as sudden steering changes. |
| Deactivation by the system malfunction | – Faulty rader / camera / ECU<br>– When the related modules and CAN communication have failures |

2. Limitations

| | |
|---|---|
| Environmental factor | – Inclement weather such as heavy rain or snow obscures the field of view of the radar sensor or camera<br>– The driver's field of view is not well illuminated (either too dark or too much reflection or too much backlight that obscures the field of view<br>– The camera/radar is contaminated. |
| Limitations in camera and radar detection | – The vehicle/pedestrian appears abruptly (beyond field of view).<br>– The vehicle in front is too small to be detected (for example a motorcycle or a bicycle, etc.).<br>– The vehicle in front does not have their rear lights properly turned ON.<br>– The vehicle in front is driving towards your vehicle or reversing.<br>– The pedestrian is not fully detected by the system, for example, if the pedestrian is leaning over or is not fully walking upright.<br>– The pedestrian is wearing clothing that easily blends into the background, making it difficult to be detected by the system.<br>– The outside lighting is too bright (e.g. when driving in bright sunlight or in sun glare) or too dark (e.g. when driving on a dark rural road at night). |

| | |
|---|---|
| | – The pedestrian is moving very quickly or appears abruptly. |

## - Operation

1. Basic specification (front camera applied)

Click to see large image...

※ The time indicated will be changed according to vehicle speeds.

- Step 1 : Issue a visual (display) and vocal alarm when a danger is detected.
- Step 3 : Activate emergency brake when a collision is imminent.
- After stopping the vehicle : Maintain the braking control for a certain time and then release it.

**Information**

- Braking power is adjusted depending on the risk levels of collision, but it is released immediately when it detects the driver's action to avoid a collision.

1) When it exceeded the maximum operation speed.
2) When it detected driver's action to avoid a collision such as sudden steering changes.
3) When the shift lever is in R or P
4) When you pressed the accelerator pedal half way.

**CAUTION**

1) When you drive at 60km/h or faster, the system does not go to step 3 of emergency braking.
   - But a collision may occur at depending on the road conditions.
   - 1step alarm operating speed range (cluster speed) : 8 - 160 kph
   - 3step alarm operating speed range (cluster speed) : 8 - 60 kph
2) Offset should be less than 50%.
3) FCA does not work on the vehicles backing up or resisting.

**Information**

Offset : Rate of non-overlapping on the line between the front driving car and my car

1) Offset 0% :

Click to see large image...

2) Offset 100% :

Click to see large image...

2. When the Smart Cruise Control is applied at the same time (front radar added)

Click to see large image...

The time indicated will be changed according to vehicle speeds.

- Step 1 : Issue a visual (display) and vocal alarm when a danger is detected.
- Step 2 : Reduce engine torque and activates FCA when there is a high chance of collision.
- Step 3 : Activate emergency brake when a collision is imminent.
- After stopping the vehicle : Maintain the braking control for a certain time and then release it.

**Information**

- Braking power is adjusted depending on the risk levels of collision, but it is released immediately when it detects the driver's action to avoid a collision.

1) When it exceeded the maximum operation speed.
2) When it detected driver's action to avoid a collision such as sudden steering changes.
3) When the shift lever is in R or P
4) When you pressed the accelerator pedal half way.

**⚠ CAUTION**

1) When you drive at 85km/h or faster, the system does not go to step 3 of emergency braking.
   - But a collision may occur at depending on the road conditions.
   - Partial braking may be applied according to the surrounding environment.
   - For the vehicle parked in front, full braking is applied at level 3 after the warning only when the vehicle speed is under 75 km/h.
   Up to level 2 is performed when the vehicle speed is over 75 km/h.
   - For the pedestrian and cyclists, full braking is applied at level 3 after the warning only when the vehicle speed is under 65 km/h.
   Up to level 1 is performed when the vehicle speed is over 65 km/h.
   - 1step/2step alarm operating speed range (cluster speed) : 8 - 160 kph
   - 3step alarm operating speed range (cluster speed) : 8 - 90 kph
2) Offset should be less than 50%.
3) FCA does not work on the vehicles backing up or resisting.

**Information**

Offset : Rate of non-overlapping on the line between the front driving car and my car

1) Offset 0% :

Click to see large image...

2) Offset 100% :

Click to see large image...

## - Components

The following is the configuration of the FCA system.

## [Basic specification (Front camera applied)]

– Detection device (radar and camera) that can recognize potential obstacles in the front.
– Human-Machine Interface (HMI) to warn driver or change settings.
– Braking system to automatically brake the car

Click to see large image...

## [When the Smart Cruise Control is applied at the same time (Front radar added)]

– Detection device (radar and camera) that can recognize potential obstacles in the front.
– Human-Machine Interface (HMI) to warn driver or change settings.
– Braking system to automatically brake the car

FCA, contrary to FCA (Smart Cruise Control), has to work on a stationary car so the system uses the Fusion Target system to combine radar with camera.

Click to see large image...

## - Schematic Diagram

Click to see large image...

- Terminal Function

Click to see large image...

| No | Function |
|---|---|
| 1 | IGN |
| 2 | - |
| 3 | - |
| 4 | L-CAN High |
| 5 | L-CAN Low |
| 6 | - |
| 7 | - |
| | |

| | |
|---|---|
| 8 | C-CAN High |
| 9 | C-CAN Low |
| 10 | GND |



## - Inspection

### Driver Setting

– The ON/OFF for FCA is included in the USM (User Setting Menu) and the default is ON.
– While IGN is On, it stays at ON, however, the driver's settings do not last next time when IGN is newly On.
– When VDC is OFF, FCA is also turned OFF.

### Inspection procedure for vehicle with Forward Collision-Avoidance Assist system failure

1. Check the bumper appearance for accident (check the vehicle appearance visually and see bumper replacement history).
   ☞ In case of the vehicle was involved in an accident, there is a high possibility that the FCA radar is out of the original default position.
2. Check for contamination of the radar sensor cover of the bumper.
   ☞If contaminated, there is a high possibility that the FCA system is deactivated during operation due to the foreign substances.
3. After turning on the engine, check the FAC warning lamp and DTC.
   (Refer to the DTC diagnosis guide.)

## - Removal

**⚠ CAUTION**

• Be careful not to damage the parts located under the vehicle (floor under cover, fuel filter, fuel tank and canister) when raising the vehicle using the lift.
(Refer to General Information - "Lift and Support Points")

### [FCA Radar]

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the front bumper cover.
   (Refer to Body - "Front Bumper Assembly")
3. Disconnect the FCA rader connector (A).
4. Remove the FCA rader (B) after loosening the FCA rader mounting nuts.

**Tightening torque :**
3.9 - 4.3 N.m (0.40 - 0.44 kgf.m, 2.9 - 3.2 lb-ft)

Click to see large image...

## [Lane Keeping Assist (LKA) Unit]

FCA, contrary to SCC w/ S&G has to work on a stationary car so the system uses the Fusion Target system to combine radar and camera.

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the lane keeping assist (LKA) unit.
   (Refer to Body Electrical System - "Lane Keeping Assist (LKA) Unit")

### - Installation

## [FCA Radar]

**NOTICE**

- Put the vehicle on the level ground.
- Take out heavy luggage from the vehicles' seats or trunk.
- Set all tires according to the specified pressure.
- Check wheel alignment.
- Check that the front surface of the front radar is clean.

1. Check the last 2 digits of Lot. No (A) on label at rear side before installing the front radar.

**Information**

- The meaning of Lot. No (A) is the vertical deviation angle of front radar inner side.

Click to see large image...

2. Install the front radar (B) by tightening the nuts.

   **Tightening torque :**
   3.9 - 4.3 N.m (0.40 - 0.44 kgf.m, 2.9 - 3.2 lb-ft)

3. Connect the front radar connector (A).

Click to see large image...

4. If replaced the front radar with a new one, perform variant coding procedure by using the GDS.

Click to see large image...

5. Check and align the front radar mounting angle.
   (1) Perform the "inspection/correction of the front-radar mounting angle" using the GDS.

Click to see large image...

Click to see large image...

(2) Input 2 digits of value in the code input box, then press "OK"

Click to see large image...

(3) Check the vertical angle which is compensated error on KDS.

**Information**

- The result value is final goal vertical angle which is compensated inner error of criteria vertical installation angle -1°.

Click to see large image...

(4) Check the front radar vertical angle by using the vertical protractor (tiltmeter).

Click to see large image...

**NOTICE**

- Make sure to perform zero setting before using vertical protractor. (perform this procedure periodically)
- Be noticed about indicated +/- differently by the way to indicate of vertical protractor.

(5) Adjust to "target vertical angle" by turning adjusting screw of front radar.

– turning clockwise : adjusting (+) angle

– turning counterclockwise : adjusting (-) angle

**NOTICE**

- There is a chance to be transformed of bracket if adjusting screw with over strength.
- Must recheck with vertical protractor if vertical angle is right after adjusting.

Click to see large image...

Click to see large image...

| of adjustment screw rotation | Correction angle | |
|---|---|---|
| | Clockwise | Counter clockwise |
| 0.5 | + 0.5˚ | - 0.5˚ |
| 1 | + 1.0˚ | - 1.0˚ |
| 1.5 | + 1.5˚ | - 1.5˚ |
| 2 | + 2.0˚ | - 2.0˚ |
| 2.5 | + 2.5˚ | - 2.5˚ |
| 3 | + 3.0˚ | - 3.0˚ |
| 3.5 | + 3.5˚ | - 3.5˚ |
| 4 | + 4.0˚ | - 4.0˚ |
| | | |

| | | |
|---|---|---|
| 4.5 | + 4.5˚ | - 4.5˚ |
| 5 | + 5.0˚ | - 5.0˚ |

6. Install the front bumper assembly.
   (Refer to Body - "Front Bumper Assembly")
7. Perform the FCA radar inspection/correction procedure by using the SST.
   (Refer to FCA Radar - "Adjustment")

## [Lane Keeping Assist (LKA) Unit]

FCA, contrary to SCC w/ S&G has to work on a stationary car so the system uses the Fusion Target system to combine radar and camera.

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the lane keeping assist (LKA) unit.
   (Refer to Body Electrical System - "Lane Keeping Assist (LKA) Unit")

### - Adjustment

## FCA Radar Installation Angle Checking/adjustment Overview

The front radar detects control subject in front, and recognize distance from the subject, comparing speed and etc,. For these reasons the direction of installation has to be on collinear with vehicle. Therefore, installing angle inspection and adjustment have to be done in case of the FCA radar removed and reinstalled caused by accident or install a new front radar. Accuracy of the front radar cannot be guaranteed if inspection and adjustment have not been done in case of mentioned situation before.

Front radar inspection/adjustment have to be done with either stop mode (C1) or drive mode (C2) using by GDS

Perform adjustment procedure with exclusive adjustment reflector (SST) for stop mode (C1).

**Information**

- after operating stop mode, the accuracy will be increased if the vehicle has driven more than 10 min.
  (drive on straight lane which has metallic reflector.)
- Operate adjustment on real road driving (drive on the road that has many metallic fixed reflector such as guard rail) for drive mode. (C2)

**Information**

The cases that front radar installation angle checking/adjustment are needed.

- Front radar has been replaced
- Front radar has been removed and reinstalled.
- Line up failed DTC has been occurred
- Failure on front radar detecting and cognition function

– failed to detect vehicle in front while functioning

– often detecting error of side lane

– often detecting error even though any object is not in front

## How to Check/adjust Front Radar Installation Angle - Stop Mode

**NOTICE**

Preparation before the front radar alignment:

- Put the vehicle on the level ground.

- Take out heavy luggage from the vehicles' seats or trunk.
- Set all tires according to the specified pressure.
- Check wheel alignment.
- Check that the front surface of the front radar is clean.

**NOTICE**

- Perform in an area with minimum clearance of 8m (26.2 ft) front, 4m (13.1 ft) sides, and 2m (6.6 ft) above the vehicle.
- Install the reflector exactly 2.5m (8.2 ft) away from the Front Radar.
- The reflector has to be installed at same place (height and angle) as front radar center.
  (If height and angle are different, then adjustment can not be done correctly.)
- Remove objects (metal plates, resins, etc.) that may cause electric signal interference from the area where front radar alignment is performed.
- Make sure to use exclusive reflector (OK964-J5100)
- Be sure that the vehicle is not moved and free from vibration when performing front radar alignment (getting in/out or opening/closing doors).
- IG has to be on when performing front radar alignment. (engine stop condition)

1. Stop the vehicle horizontally at a flat place.

Click to see large image...

2. Mark the center point of emblem (A).

Click to see large image...

3. Mark the center point (B) after measuring the distance on top of wind glass.

Click to see large image...

4. Install the laser (09964-C1200) to the tripod (09964-C1300).

Click to see large image...

5. Place the laser (09964-C1200) at 2.5m (8.2 ft) to the front of the vehicle.

Click to see large image...

6. Match the vertical line of laser to (A) and (B) using the laser (09964-C1200).

Click to see large image...

7. Mark (C) at 2.5 mm (8.2 ft) from (A) in front of the vehicle.

Click to see large image...

8. Mark (D) at the place which is 7mm (0.276 inch) away from (C) to the right in vertical direction.

Click to see large image...

9. Remove the laser (09964-C1200) from the tripod (09964-C1300).

Click to see large image...

10. Mount the reflector (09964-C1100) onto the tripod (09964-C1300).

Click to see large image...

11. Mount the reflector adapter (0K964-J5100) to the reflector (09964-C1100).

Click to see large image...

12. Set the reflector horizontal using the leveler (A) which is built in the tripod (09964-C1300).

Click to see large image...

13. Align the vertical weight (A) of the reflector (0K964-J5100) with the point (D).

Click to see large image...

14. Set the height of the reflector adapter (0K964-J5100) to 401mm (15.78 inch).

Click to see large image...

15. Remove the vertical weight from the reflector (0K964-J5100).

**NOTICE**

- It can be effected to adjustment if the vertical weight is still left.

16. Check again the front radar and the surface of front bumper for the following items with the eyes.

**NOTICE**

- Make sure that there is no debris, or reflecting object on the surface of the radar.

- Make sure that there is no debris, or reflecting object on the radiator grill.

17. Select C1 (stop mode) to inspect and adjust the front radar installation angle by following procedure on GDS screen.

Click to see large image...

Click to see large image...

Click to see large image...

18. In case of front radar inspection/correction failure, check the inspection/correction conditions.